Contribution ID: **22** Type: **Invited Talk**

A Single-Ion Information Engine for Charging Quantum Battery

Wednesday, 10 December 2025 09:30 (50 minutes)

In this talk, I will present an implementation of a microscopic information engine in a trapped-ion system, where quantized mechanical motion plays the role of a quantum battery. Information engines convert measurement and feedback into useful work, but a central challenge is how to store the extracted work in a controllable and reusable way. Our experiment addresses this by repeatedly charging the motional mode of a single trapped ion through measurement-based feedback, enabled by a fast, high-fidelity state-discrimination scheme that strongly suppresses measurement back-action on the motion. We achieve an information-to-ergotropy conversion efficiency of up to about 67% of the theoretical limit at an optimal reservoir temperature, and a maximum information-to-work conversion efficiency of 70%. These results show that trapped ions provide a powerful platform for studying information thermodynamics at the quantum level and for realizing microscopic information engines. If time allows, I will also briefly discuss our related efforts on scaling up to larger qubit numbers using two-dimensional ion crystals. This talk is based on our recent work, Phys. Rev. Lett. 135, 140403 (2025).

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